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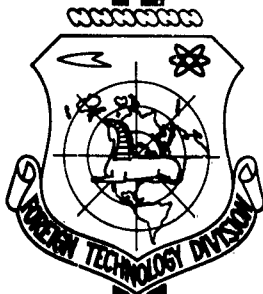
# TRANSLATION

FROM A PROGRAM MACHINE TO AN  
AUTOMATIC PLANT (SELECTED ARTICLE)

By

M. A. Khabenskiy

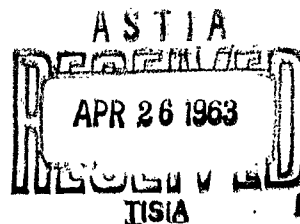
## FOREIGN TECHNOLOGY DIVISION



AIR FORCE SYSTEMS COMMAND

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## UNEDITED ROUGH DRAFT TRANSLATION

FROM A PROGRAM MACHINE TO AN AUTOMATIC PLANT (SELECTED ARTICLE)

BY: M. A. Khabenskiy

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## From a Program Machine to an Automatic Plant

by

M. A. Khabenskiy

The program control system of metal cutting machines opens broad perspectives for automation in machine construction.

The machine with program control automatically machines a detail in conformity with the given program, remaining universal and permitting the manufacture of any other detail in accordance with the new program. Such machines are irreplaceable during experimental operations, particularly in rocket construction, turbine construction, aircraft construction, radio engineering. Machines with program control are most perspective for small series and individual manufacture, because they allow for a rapid change in program.

Program control of processing radioactive and other materials hazardous for human health requires no direct participation of man in the process of machining.

The installation of program machines into automatic lines will allow to considerably reduce the time necessary for adjustment of lines when the type of machines detail has been changed, and simplify the adjustment process. Thanks to this automatic lines will find broad application in small scale manufacture.

As an example we want to discuss one of the first automatic lines with digital program control- a line for machining reductor bodies.

This line consists of three machines: on the first one of them is done the milling the second one is intended for drilling, threading, reaming, countersinking etc. This machine has a turret head for twenty different cutting tools. The capstan is fixed automatically in necessary position. The third machine is a boring machine. It has two spindles - a spindle for boring and a spindle for milling with single tooth mil-

ling cutter. The working radius of the single tooth cutter can be changed automatically. The control system for the line is positional.

The dimensions of details and sequence of machining operation are recorded on a card and then stamped with the aid of a perforator on a perforation band. The perforation band goes into the reading mechanism of an electronic digital computer. In conformity with data, written on the perforation tape, the control device sends to the machine of the automatic line measuring commands, fixing in working position and execution of cutting operations. The wear of the cutting tools is compensated in the control arrangement without correcting the tapes with the programs.

The machined details are loaded by the operator into clamps. The clamps with detail in it fall into a transportation mechanism. From this moment on transportation of detail from machine to machine, fixing of contrivances and operation of various organs of each machine are executed automatically.

For the given line is provided the possibility of simultaneously machining four details (identical or different) with control from four perforation tapes. The number of tapes can be even greater, if in the line will be set up devices for transportation and machining a considerable number of details.

After each machine will execute the given operations, the clamp together with the detail will be automatically transferred to the following machine. This is repeated until the ready details reaches the unloading-loading position.

In the automatic line for manufacturing reductor bodies are set up three machines.

At a conventional manufacturing method this required twenty-two machines. For the manufacture of each body were consumed eight hours, or sixteen weeks for 100 details. With the employment of an automatic line the machining of one hundred bodies takes up a total of two days. Such a gain in labor output is obtained thanks to the use of new automation principles. This new thing lies in the use of electronic digital computers.

Machines with program control - is one of the first steps in the utilization of digital computers for the automation of industrial processes in machine construction. Program control systems will give the possibility of creating reliably functioning automatic enterprises, since they allow not only to control the equipment, but also constantly watch the correctness of its operation, check the dimensions of machined details and signal about disorders, about their nature and place of origination, and in necessary instances disconnect a machine of a group of machines.

And involuntarily before the eyes appears a picture of the near future.

We enter a large new plant. Everything here is unusual. Mounted in lines are machines. No workers can be seen. Mechanical hands remove from the machines machined details and place them on transporters, which deliver the details to other machines. Ready components are checked on a control automat in all parameters and go into assembly. All the units in the workshop are controlled by a computer. This machine is continuously processing the multitude of information, travelling over communication lines from all controlled units. In conformity with the given technological process the machine works out signals, commanding the work of each automat in the workshop. And only at the central control panel do we see a person. He makes periodic checks of instrument indications. Here on the central panel the entire technological process is being fully reproduced.

Suddenly a red light goes on, and emergency bell sounds: one of the machines went out of commission. A immediately repairmen hurry toward the point of trouble.

And that is how it will be !

Already now high speed digital computers are being used successfully for complex automation of industrial processes. With the aid of these machines are controlled the operations of smelters and Martin furnaces, rolling mills, boring machines, mining combines etc.

Automation of machine construction has its specificity, its difficulties, about

which we have already spoken. Employment of machines with digital program control is one of the most perspective trends in solving these difficulties.



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